

Appendix C: Information Sheet

Fundamental Constants

Avogadro's number (N_A)	6.022 x 10 ²³ /mol	Mass of electron	9.11 x 10 ⁻³¹ kg
Specific heat of H ₂ O (I)	4.184 J/(g•°C)	Mass of neutron	1.67 x 10 ⁻²⁷ kg
Gas constant (R)	0.08205 (L•atm)/(mol•K)	Mass of proton	1.67 x 10 ⁻²⁷ kg
	8.314 J/(mol•K)	Speed of light in vacuum (c)	3.00 x 10 ⁸ m/s
Planck's constant (h)	6.63 x 10 ⁻³⁴ J•s	Rydberg's constant (R_H)	2.18 x 10 ⁻¹⁸ J

Conversion Factors

1 atm = 760 mmHg (torr) = 101,325 N/m ² (Pa)	giga (G) = 10 ⁹
1 Faraday = 96,500 coulombs = 1 mole electrons = 96.5 kJ/volt	mega (M) = 10 ⁶
1 Hz = s ⁻¹	kilo (k) = 10 ³
°C = (°F - 32) x 5/9	deci (d) = 10 ⁻¹
0 °C = 273.15 K	centi (c) = 10 ⁻²
1 amu = 1.66 x 10 ⁻²⁴ g	milli (m) = 10 ⁻³
1 cal = 4.184 J	micro (μ) = 10 ⁻⁶
1 J = 1 N•m = 1 kg•m ² /s ²	nano (n) = 10 ⁻⁹
1 kg = 2.20 lbs	pico (p) = 10 ⁻¹²
1 in = 2.54 cm	femto (f) = 10 ⁻¹⁵
1 gal = 3.79 L	1 mL = 1 cm ³
1 mile = 1.61 km	1 hr = 3600 sec
1 liter = 1 x 10 ³ cm ³	

Formulas

$d = \frac{m}{v}$	% yield = $\left(\frac{\text{actual yield}}{\text{theoretical yield}}\right) \times 100$	$\frac{g}{FW} = \text{moles}$	Molarity(M) = $\frac{\text{moles of solute}}{\text{volume of solution}}$
PV=nRT	$PV = \frac{gRT}{M}$	$d = \frac{PM}{RT}$	$\left(P + \frac{n^2 a}{V^2}\right)(V - nb) = nRT$
$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$	$X_i = \frac{n_i}{n_T}$	$u = \sqrt{\frac{3RT}{M}}$	$M_i V_i = M_f V_f$
$\frac{r_2}{r_1} = \sqrt{\frac{M_1}{M_2}}$	$Z_{\text{eff}} = Z - S$	$E = \frac{k Q_1 Q_2}{d}$	$P_{\text{total}} = P_1 + P_2 + P_3 + \dots$
$E_n = -R_H \left(\frac{1}{n^2}\right)$	$\Delta E = E_{\text{final}} - E_{\text{initial}}$	$E = mc^2$	$E = h\nu = \frac{hc}{\lambda}$
$q_{\text{rxn}} = -C_{\text{cal}}\Delta T$	$\Delta E = q + w$	$q_{\text{rxn}} = -q_{\text{soln}}$	$\lambda = \frac{h}{p} = \frac{h}{mv}$
$\Delta H = q_p$	$\Delta E = h\nu = -R_H \left(\frac{1}{n_f^2} - \frac{1}{n_i^2}\right)$	$q_{\text{soln}} = mC_{\text{soln}}\Delta T$	$w = -P\Delta V$
Molality (m) = $\frac{\text{moles of solute}}{\text{mass of solvent (kg)}}$	Solubility = $k \cdot P$	$\Delta T_b = iK_b m$	$\mu = Q r$
$P_{\text{mixt}} = X \cdot P_A^0 + X \cdot P_B^0$	$\ln[A]_t = -kt + \ln[A]_0$	$\Delta T_f = iK_f m$	$\Pi = iMRT$
$\log\left(\frac{k_2}{k_1}\right) = \left(\frac{-Ea}{2.303R}\right) \cdot \left(\frac{1}{T_2} - \frac{1}{T_1}\right)$	$\ln\left(\frac{P_2}{P_1}\right) = \left(\frac{\Delta H_{\text{vap}}}{R}\right) * \left(\frac{1}{T_1} - \frac{1}{T_2}\right)$	$t_{1/2} = \frac{0.693}{k}$	$k = Ae^{-Ea/RT}$
		$\frac{1}{[A]_t} = kt + \frac{1}{[A]_0}$	$t_{1/2} = \frac{1}{k[A]_0}$
			$\Delta H_{\text{rxn}}^0 = \sum n\Delta H_f^0(\text{products}) - \sum m\Delta H_f^0(\text{reactants})$

FC = (valence electrons in free atom) – (valence electrons in bound atom)

$\Delta H^0 = D$ (bonds broken) – D (bonds formed)

Appendix A: Solubility Guidelines for Common Ionic Compounds in Water

These ions are soluble	Exceptions
Li^+ , Na^+ , K^+ , Rb^+ , Cs^+ , NH_4^+	none
NO_3^- , ClO_3^- , BrO_3^-	none
$\text{C}_2\text{H}_3\text{O}_2^-$	none
Cl^- , Br^- , I^-	Compounds formed with Ag^+ , Hg_2^{2+} , and Pb^{2+}
SO_4^{2-}	Compounds formed with Ca^{2+} , Sr^{2+} , Ba^{2+} , Ag^+ , Hg_2^{2+} , and Pb^{2+}
These ions are insoluble	Exceptions
CO_3^{2-}	Compounds formed with Group 1A ions, and NH_4^+
PO_4^{3-}	Compounds formed with Group 1A ions, and NH_4^+
S^{2-}	Compounds formed with Group 1A ions, and NH_4^+
OH^-	Compounds formed with Group 1A ions, NH_4^+ , Ca^{2+} , Sr^{2+} , Ba^{2+}

Appendix B: Activity Series of Metals in Aqueous Solutions

Metal	Oxidation Reaction
Lithium	$\text{Li} \longrightarrow \text{Li}^+ + \text{e}^-$
Potassium	$\text{K} \longrightarrow \text{K}^+ + \text{e}^-$
Barium	$\text{Ba} \longrightarrow \text{Ba}^{2+} + 2 \text{e}^-$
Calcium	$\text{Ca} \longrightarrow \text{Ca}^{2+} + 2 \text{e}^-$
Sodium	$\text{Na} \longrightarrow \text{Na}^+ + \text{e}^-$
Magnesium	$\text{Mg} \longrightarrow \text{Mg}^{2+} + 2 \text{e}^-$
Aluminum	$\text{Al} \longrightarrow \text{Al}^{3+} + 3 \text{e}^-$
Manganese	$\text{Mn} \longrightarrow \text{Mn}^{2+} + 2 \text{e}^-$
Zinc	$\text{Zn} \longrightarrow \text{Zn}^{2+} + 2 \text{e}^-$
Chromium	$\text{Cr} \longrightarrow \text{Cr}^{3+} + 3 \text{e}^-$
Iron	$\text{Fe} \longrightarrow \text{Fe}^{2+} + 2 \text{e}^-$
Cobalt	$\text{Co} \longrightarrow \text{Co}^{2+} + 2 \text{e}^-$
Nickel	$\text{Ni} \longrightarrow \text{Ni}^{2+} + 2 \text{e}^-$
Tin	$\text{Sn} \longrightarrow \text{Sn}^{2+} + 2 \text{e}^-$
Lead	$\text{Pb} \longrightarrow \text{Pb}^{2+} + 2 \text{e}^-$
Hydrogen	$\text{H}_2 \longrightarrow 2 \text{H}^+ + 2 \text{e}^-$
Copper	$\text{Cu} \longrightarrow \text{Cu}^{2+} + 2 \text{e}^-$
Silver	$\text{Ag} \longrightarrow \text{Ag}^+ + \text{e}^-$
Mercury	$\text{Hg} \longrightarrow \text{Hg}^{2+} + 2 \text{e}^-$
Platinum	$\text{Pt} \longrightarrow \text{Pt}^{2+} + 2 \text{e}^-$
Gold	$\text{Au} \longrightarrow \text{Au}^{3+} + 3 \text{e}^-$

Ease of oxidation increases 

Appendix D:

Periodic Classification of the Elements

IA												VIIA				VIII A	
1 H 1.0080												1 H 1.0080	2 He 4.003				
IIA												III A	IVA	VA	VIA		
3 Li 6.940	4 Be 9.013											5 B 10.82	6 C 12.011	7 N 14.006	8 O 16.000	9 F 19.00	10 Ne 20.183
11 Na 22.991	12 Mg 24.32	III B	IV B	VB	VIB	VII B	VIII B		IB	IIB	13 Al 26.98	14 Si 28.09	15 P 30.975	16 S 32.066	17 Cl 35.457	18 Ar 39.944	
19 K 39.100	20 Ca 40.08	21 Sc 44.96	22 Ti 47.90	23 V 50.95	24 Cr 52.01	25 Mn 54.94	26 Fe 55.85	27 Co 58.94	28 Ni 58.71	29 Cu 63.54	30 Zn 65.38	31 Ga 69.72	32 Ge 72.60	33 As 74.91	34 Se 78.96	35 Br 79.90	36 Kr 83.80
37 Rb 85.48	38 Sr 87.63	39 Y 88.92	40 Zr 91.22	41 Nb 92.91	42 Mo 95.95	43 Tc (98)	44 Ru 101.1	45 Rh 102.91	46 Pd 106.04	47 Ag 107.88	48 Cd 112.41	49 In 114.82	50 Sn 118.70	51 Sb 121.70	52 Te 127.61	53 I 126.91	54 Xe 131.30
55 Cs 132.91	56 Ba 137.36	57-71 see La Series	72 Hf 178.50	73 Ta 180.95	74 W 183.86	75 Re 186.22	76 Os 190.2	77 Ir 192.2	78 Pt 195.09	79 Au 197.0	80 Hg 200.61	81 Tl 204.39	82 Pb 207.21	83 Bi 209.00	84 Po (210)	85 At (210)	86 Rn (222)
87 Fr (223)	88 Ra 226.05	89-103 see Ac Series	104 Unq (257)	105 Unp (260)	106 Unh (263)	107 Uns (262)	108 Uno (265)	109 Une (266)									

Lanthanide Series

57 La 138.92	58 Ce 140.13	59 Pr 140.92	60 Nd 144.27	61 Pm (147)	62 Sm 150.35	63 Eu 152.0	64 Gd 157.26	65 Tb 158.93	66 Dy 162.51	67 Ho 164.94	68 Er 167.27	69 Tm 168.94	70 Yb 173.04	71 Lu 174.99
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Actinide Series

89 Ac 227	90 Th 232.05	91 Pa (231)	92 U 238.07	93 Np (237)	94 Pu (242)	95 Am (243)	96 Cm (247)	97 Bk (247)	98 Cf (251)	99 Es (251)	100 Fm (253)	101 Md (256)	102 No (254)	103 Lw (257)
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